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INFORMATION SUPERIORITY: TEAMING THE COMMANDER AND THE "SYSTEM OF SYSTEMS" IN 2010

By

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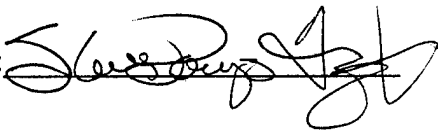
A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Maritime Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

Signature: 

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With systems as complex, expansive and interconnected as those envisioned, there will always be a vulnerability which can be exploited. In the event of failure, our commanders will still have the responsibility to continue the decision process and optimally employ all of the assets available to achieve the desired end state of an operation.

In addition to enabling battlespace dominance, information superiority thus becomes an issue of teaming technology and knowledge with the commander, providing the requisite tools for developing and honing the traits necessary for maintaining effective command and control in the face of disrupted information flow.

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TABLE OF CONTENTS

Abstract of

INFORMATION SUPERIORITY: TEAMING THE COMMANDER WITH THE SYSTEM OF SYSTEMS IN 2010

The information systems envisioned in Joint Vision 2010 will provide the Commander with an unprecedented level of battlespace awareness to aid in the decision making process. Today, advanced information systems are having a significant impact on our personal and professional lives. Our increased reliance already makes their failure more disruptive than just a few years ago. Though the complete implications for operations in the military are not clear, one thing that has changed and will continue to change for the commander in this "revolution in real time" is the volume of and speed at which the information influencing decisions flows, as well as the speed at which decisions must be made before opportunities are lost.

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INTRODUCTION

As envisioned in Joint Vision 2010, the Operational Commander will have at his fingertips an unprecedented level of information gathering, collation and dissemination capability to aid in the decision making process, the extent of which is not even now discernible. The command structure as we know it may be drastically altered to take full advantage of the opportunities to dominate the battlespace provided by these new technological capabilities. Regardless of the level of technology put at their disposal, one aspect which will not change is the responsibility our commanders will have to optimally employ all of the assets available to achieve the desired end state of an operation. In implementing the "system of systems," it will be necessary develop a "commander-system team" that provides the commander with the requisite tools to develop and hone leadership and decision making skills. Such a system would not only allow the commander to achieve information superiority and success in the battlespace commensurate with Joint Vision 2010, but also allow the flexibility necessary for continued effective decision making in the absence or severe degradation of information flow.

INFORMATION ISSUES

From the time of triremes and foot messengers, to the beginnings of long range communications systems in the 19th century, to the global high velocity transmission of graphical information today, the speed of information transfer and dissemination has been accelerating. The speed of information flow from point to point has gone from days and

months to minutes and seconds, and will likely continue into the seconds and sub-seconds. The Information age is the present, not a period of the future. It is an age where technology -- specifically information technology -- is drastically changing the structure of our society.

The Information Age

The technological transformation in our society today is marked by rapid global economic growth, expanding educational resources and intellectual development. It will likely continue this trend into the foreseeable future. Cellular phones, pagers, and personal computers are no longer expensive toys for the few. They have now become integral to our day to day lives. We depend on them and suffer when they fail.

Improved information systems -- digital Personal Communications Systems (PCS), Satellite Television and the World Wide Web in particular -- have drastically increased our personal information assimilation and transfer capability. These information systems are growing closer together both functionally and technologically. They will likely, only a few years from now, merge into a linked series of interactive networks. Furthermore, our accessibility to these networks will greatly increase. It has been predicted that an item referred to as the "PC Wallet" could replace almost every article we can potentially carry with us today -- personal organizers, cellular phones, pagers, laptop personal computers, internet connection devices, Global Positioning System (GPS) receivers and trackers, money (all forms), security accesses and keys, identification, and even pictures -- and it will not be much larger than a cellular phone is today.

Informational functions we do manually today could be automated utilizing this type of device. For example, the "PC wallet" might be programmed to detect and monitor digital broadcasts of traffic and weather information, then provide automatic notification and recommended routing and scheduling changes should those conditions impact planned events. The capability of this type of system could easily be tailored to fit both individual needs and expense limits.[1]

These impacts are not only on the individual, but are affecting the business world as well. Within the United States, the investment in information technology amounted to 3% of the total economy in 1996. That same year, information technology was, at 33%, the single largest contributor to the growth in gross domestic product.[2] Economically feasible information conduits that can transfer data at an amazing 1.5 million bytes per second, more than 25 times common Integrated Services Digital Network (ISDN) lines and 50 times faster than normal phone lines, are available now. This transfer capability, together with newer graphics processing technology, provides the ability to rapidly transmit intricate conceptual models for building an accurate informational picture to aid in making sound decisions in business management and development.

Businesses are changing how they are structured to take advantage of the edge that information technology can provide. Corporate restructuring includes a shift from the traditional, hierarchical operating structure to what has come to be termed "Network Centric" operations, centered on focus of effort, eliminating duplicity, and shortening the timeline

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[1]Bill Gates. The Road Ahead, 2nd ed. (New York: Penquin Books, 1996), 81-85.
[2]Michael J. Mandel "The New Business Cycle", Business Week, November 17, 1997, 58-68.

between supply and consumer. The competitive "battleground" for corporations is expanding ever increasingly towards global proportions. Corporations which have made this shift have noted a large increase in profits and easier control of the competitive marketplace.[3]

Furthermore, there is an increased use of software and hardware systems to automate routine, and often manpower intensive, processes. One of these are software "agents," programs that track patterns or activities and begin to automate functions which are repetitive.[4] Another is neuro-computing, using specialized systems that are designed for narrow functions and can build on their statistical base. They are essentially programmed to "learn" to search for and recognize patterns in data that are more complex than can be easily recognized by humans. A simple illustration of these capabilities can be found in routine administrative assistant duties. For example; every day at 0730, the same five types of information are retrieved for a meeting with senior representatives from each of six different sections. An "agent" might be programmed to monitor and track this type of trend, so that prior to the 0730 daily, the system automatically pulls the data and transmits the information to the representatives with notification of the meeting. Taken one step further, if certain statistical indicators are present that historically led to a given action, an "agent" could conceivably be programmed to monitor those indicators, compile the applicable data and potential courses of action, then automatically send it to the key people involved for further analysis. Systems such as these could conceivably be designed to track and compile data on behavioral processes, such as decision making, as well as to determine statistical trends,

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[3]Arthur Cebrowski and John Gartska. "Network-Centric Warfare: It's Origin and Future", Naval Institute Proceedings, January, 1998, 30.

[4]"Agent" concept taken from Bill Gates, The Road Ahead, 2nd ed., (New York: Penquin Books, 1996), 79-93.

target operations, and training shortfalls. Corporations, investment firms, and investigative agencies, among others, have actually used systems such as these to aid in refining marketing and supply strategies, predicting investment trends and detecting activities like credit card fraud.[5]

One may wonder, however, what applicability personal and business changes actually have to the military. It has been said that the military is a mere reflection of the society which it defends. Though drastically different in the thrust and manner of their operations, there are parallels that can be drawn between the corporate world and the military. Just as corporate America is realizing the great benefits that can be reaped by incorporating innovation, information technology and optimized information handling to achieve market dominance, so the military is realizing that it can utilize these same tenets to achieve battlefield dominance. There are parallels in requirements as well. Strategically, both entities must have a detailed understanding of the "appropriate competitive battlespace." Operationally, both require close interaction and coordination among the respective units and the area of interest.[6]

The level of sophistication and capability of information systems as well as the extent that they have embedded themselves into our lives today is mind boggling. Like it or not, the fact is that the newest generation of information systems and their associated technologies are here, have been changing the way we work and live, and will continue to impact us in the

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[5]James Martin, The Great Transition: Using the Seven Disciplines of Enterprise Engineering to Align People, Technology, and Strategy, (New York: AMACOM, 1995) , 50-51.
[6]Arthur Cebrowski and John Gartska, "Network-Centric Warfare: It's Origin and Future", Naval Institute Proceedings, January, 1998, 32.

future as they evolve. The military must adapt to this changing environment if we are to maintain an operational edge. Hence, the concept of "Information Superiority."

Information Superiority

Know the enemy and know yourself; in a hundred battles you will never be in peril.

Sun Tzu[7]

Joint Vision 2010 defines Information Superiority as "the capability to collect, process and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same."[8] Information is a precious commodity, and overwhelming control of that commodity is the goal. Three major components constitute information superiority. The first is Information Operations (IO), or Information Warfare (IW) during crisis or conflict, which includes the actions taken to protect our own information resources as well as actions to affect those of the adversaries. The next component is information systems, which is a combination of all the equipment, structures and personnel that comprise the decision support system for the commander in the exercise of command and control. Information superiority's final and perhaps most critical component is relevant information, which includes all of the information pertinent to friendly forces, the enemy, and the operations area.[9]

The objective of Information Superiority is to reduce our own decision time through information management, protection and technology, continue to expand our opponents'

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[7]Sun Tzu. The Art of War. trans. Samuel B. Griffith. (New York: Oxford University Press, 1971), 84.
[8]Joint Chiefs of Staff, Joint Vision 2010. (Washington D.C.: July, 1996),16.
[9]Joint Chiefs of Staff, Concept for Future Joint Operations. (Washington, D.C.: May, 1997), 39-42.

decision cycle through offensive operations, and move away from the traditional concepts of mass against mass, or what has been referred to as the "overwhelming force" paradigm.[10] Information superiority will allow our forces to focus the correct size and type of action upon an opponent's critical vulnerabilities at the right time to achieve a mass effect. As envisioned, it will allow our forces to beat the enemy to the punch -- every time.

Optimal employment of the available assets is central to success on the battlefield and technology can be a great tool to help achieve that success. It is important to note, however, that regardless of the sophistication of the technology involved or the quality of the information that it processes, the objectives cannot be obtained without the ability of the commander to come to the right decision, at the right time, and then act accordingly. Already, increased reliance on information systems has made failure more disruptive, and the global availability of both knowledge and technology will provide would-be adversaries with the capability to effectively attack our information structures.[11] This means that the commander must continue to possess and hone keen decision making skills. Thus it is essential then to understand the human dimension -- the decision process.

> ***. . .the quality of the box matters little. Success depends upon the* [person] *who sits in it.***
>
> **Baron Von Richtoffen**[12]

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[10]Jeffrey R. Copper, "Another View of Information Warfare: Conflict in the Information Age", The Information Revolution and National Security: Dimensions and Directions, Stuart J.D Schwartzenstein ed.,(Washington D.C.: Georgetown University. The Center for Strategic & International Studies, 1996) , 126.
[11]David S. Alberts, "The Unintended Consequences of Information Age Technologies", National Defence University Books, April 1996, <http://www.ndu.edu/ndu/inss/books/uc.html> (31 January 1998), 5.
[12]Manfred A. Richthoffen and Charles G Grey, The Red Battle Flyer. (New York: R.M. McBride & Co., 1918) , 181.

The Decision Process

There are several models on decision making. The "OODA" loop,[13] is perhaps the simplest view of the fundamental decision cycle. "OODA" is an acronym for the steps which are executed by an individual to bring about an effect within the medium that they are operating. These steps are: Observe, Orient, Decide, and Act. This simple four step loop forms the basis for a slightly expanded view presented in the Concept for Future Joint Operations (CFJO).[14] Both concepts are illustrated in Figure 1.

The major difference between these two views is that the "OODA" steps in the CFJO model are now depicted as the link between the entities in the cycle -- the battlespace, information, awareness and the commander's intent and orders -- and can be thought of in terms of time. The shorter the time required for the decision cycle to complete, the smaller the loop becomes.

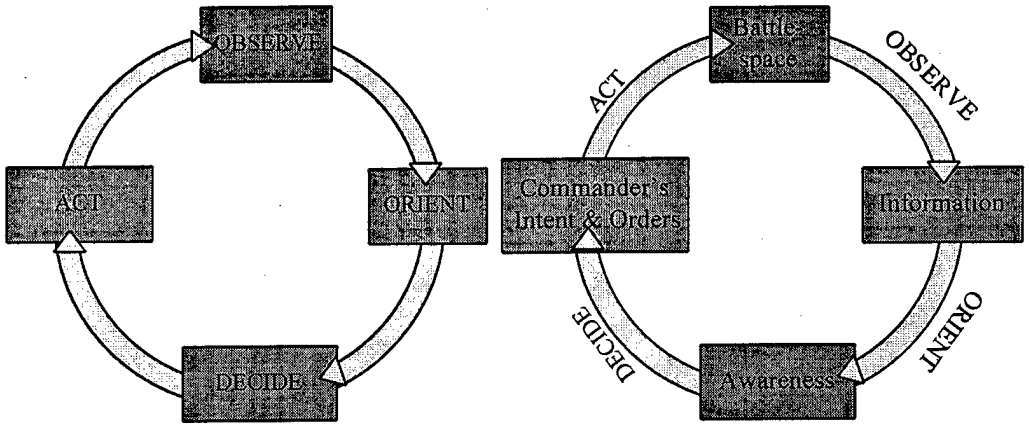

Figure 1 The "OODA Loop" on the left, and as adapted in Concept for Future Joint Operations on the right.

[13]The "OODA" loop concept is attributed to John Boyd, "Patterns of Conflict" and "An Organic Design for Command and Control", A Discourse of Winning and Losing. (Boulder, CO: Westview Press, 1985).
[14]Joint Chiefs of Staff, Concept for Future Joint Operations. (Washington, D.C.: May, 1997), 43.

The Information systems as described in the CFJO will be robust, redundant, high speed and secure. They will be composed of well developed, extensive, intertwined set of communications systems and sensor grids. Their purpose will be to provide a seamless decision making architecture that gives the commander the amount relevant information that provides an unprecedented view and awareness of the battlespace.[15] The intended impact of this "system of systems" will be to accelerate the "speed of command," effectively shortening the OODA steps, thus shrinking the CFJO decision cycle down to where the commander operates inside the cycle of the enemy. Concurrently, Information Protection (IP) will be employed to shield the command and control structure from enemy Information Warfare (IW) attack. In equilibrium, where enemy attempts at IW are blocked by effective IP, the decision cycle remains stable. If IP fails and enemy IW is successful, the cycle expands in time, the commander's decision process is slowed, and the cycle expands relative to that of the enemy. It should also be noted that use of state of the art information technology in these processes is no longer only available to traditional superpower nations. They are available to virtually everyone -- including potential enemies. An illustration of the relationship of and pressures applied to the respective decision cycles is shown in figure 2.

A unique aspect of the CFJO decision model is that it applies to all levels of military decision making, whether tactical, operational or strategic. What differs at the various levels

[15]Joint Chiefs of Staff, Concept for Future Joint Operations. (Washington, D.C.: May, 1997), 39-41.

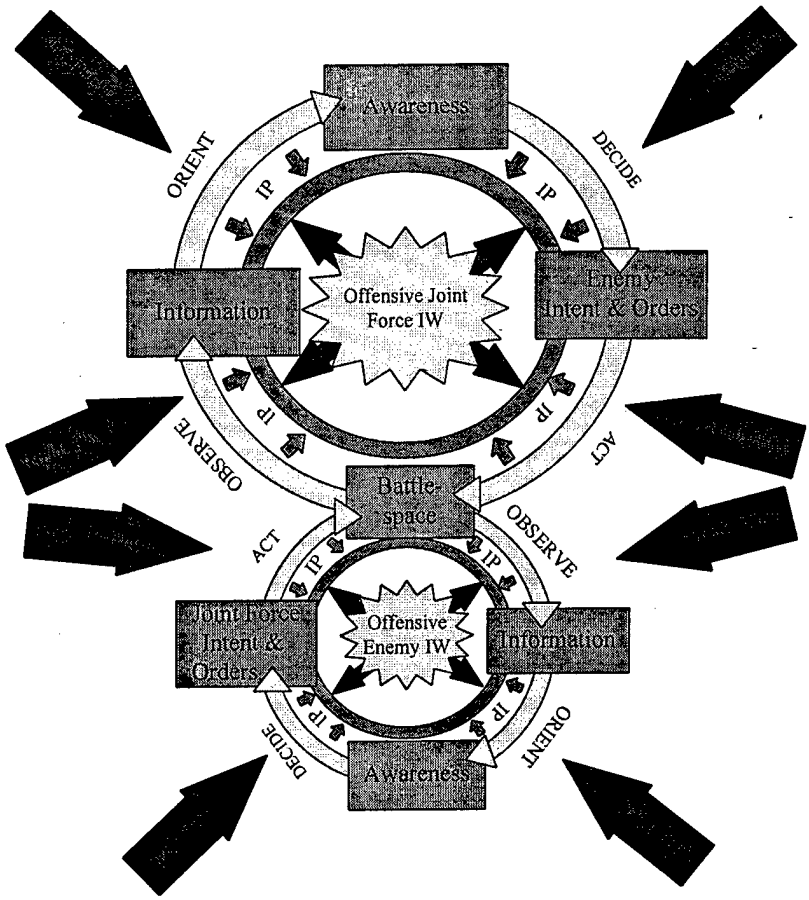

Figure 2. The Concept for Future Joint Operations "OODA" loop with the enemy orientation to the battlespace, Information Warfare and Information Technology pressures applied.

are the scope and magnitude of the decisions being made, as well as the traits of the individuals making them. The scope and magnitude of the decisions pertain to levels of war and are divergent from the thrust of this discussion. Traits in decision making are, however, applicable. Every human being perceives, processes and assimilates the same information differently. Research based on people in leadership positions from diverse backgrounds has shown that though the paths used and traits displayed in coming to decisions vary with the individuals making them, patterns develop over the course of resolving problems which can

be characterized in terms of both positive and negative processes. The positive processes -- framing, gathering intelligence, coming to conclusions and learning from feedback -- are key elements which every good decision maker must either consciously or subconsciously undertake. The negative processes -- errors associated with the positive processes -- have been characterized as "decision traps." [16] The implications of this are that people can be made cognizant of their own decision making traits and trends, and those that can learn from that can become better decision makers. For reference, Appendix A contains excerpts that further define the components of these processes.

LEADERSHIP TRAITS

> ***The dynamic nature of joint operations in the 21st century battlespace will require a continued emphasis on developing strong leadership skills.***
>
> **Joint Vision 2010**[17]

Decision making is important, but identifiable traits common in effective leadership is important as well. For this, we will try to find a common thread in history. Sun Tzu's commander was "serene, inscrutable, impartial, and self constructed," possessing the virtues of wisdom, sincerity, humanity, courage and strictness.[18] Clausewitz's commander is emotionally balanced; possesses a strength of character, will, energy, the powers of intellect, firmness and determination.[19] The terms they use to describe their commanders are very similar. They do, however, place a much different emphasis on the importance of those

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[16]J. Edward Russo and Paul J.H. Schoemaker, Decision Traps. The Ten Barriers to Brilliant Decision Making and How to Overcome Them, (New York: Dell Publishing Group, Inc., 1990) ,xvi-xviii, 2-4.
[17]Joint Chiefs of Staff, Joint Vision 2010, (Washington D.C.: July, 1996), 28.
[18]Sun Tzu, The Art of War, trans. Samuel B. Griffith, (New York: Oxford University Press, 1971), 65, 128-129, 136.
[19]Carl Von. Clausewitz, On War,Trans. Michael Howard and Peter Paret, (Princeton: Princeton University Press, 1989), 100-112.

traits. But when compared within the context of their perspectives, Sun Tzu's being strategic and Clausewitz being more operational, ". . .Clausewitz's 'military genius' and Sun Tzu's *'master of war'* or *'skillful commander'* . . .actually have much in common when their superficial differences are stripped away."[20]

Literally thousands of studies have been conducted on leaders in an attempt to quantify what it takes to become an effective leader. We have over 850 separate definitions of leadership. Theories abound as to the nature of leadership, but none are necessarily complete and stand the test of time on their own. Not surprisingly, however, the same basic traits which Clausewitz and Sun Tzu found to be important do seem to be common among effective leaders today. These individuals possess self knowledge -- they know their capabilities and limitations. They are confident and persistent in the performance of their duties. More importantly, they are avid learners -- demanding, building and broadening their knowledge base, establishing confidence in themselves and in the capabilities and limitations of those people and systems on whom they are reliant for support. They display sound judgment. They are risk takers. They thrive on challenge.[21] If it is assumed that commanders are effective leaders and possess these traits, then they are likely to be proactive in molding their environment to achieve results. Given a poor set of resources, effective commanders will still work to achieve the best chances of success in reaching the desired objectives. Given the tools to cultivate improved judgment and sound decision making, the effective commander will likely capitalize on their use.

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[20]Michael I. Handel, Masters of War Classical Strategic Thought, 2nd ed., (London: Frank Cass, 1996), 153.
[21]Warren Bennus and Burt Nanus, Leaders: Strategies for Taking Charge. (New York: HarperCollins Publishers, 1997) , 4-5; 175-176.

The "system of systems" should then possess those tools within its architecture to develop and hone both the traits in leadership and the positive decision processes which are required to consistently make good decisions. This is especially important given the speed at which those decisions must occur to ensure success in the 2010 battlespace. Like a muscle, leadership and decision skills not exercised tend to atrophy with disuse, and therefore must be regularly exercised. Compensating for system failure thus becomes an issue of teaming technology and knowledge with the commander, supplying the tools on a recurring basis in advance of the failure, to ensure the best chance of success.

TEAMING THE COMMANDER WITH THE "SYSTEM OF SYSTEMS"

In developing the team, areas must be identified which will best serve to place the tools to develop sound decision making skills and support. In this initial study, three areas appear as prime candidates: education, support systems development, and user feedback mechanisms.

Education

> ***More than ever, an education that emphasizes general problem-solving skills will be important*** **[in the information age].** ***In a changing world, education is the best preparation for being able to adapt.***
>
> **Bill Gates**[22]

> ***For Information Superiority to yield it's full potential, military decision making should be central to how we educate future leaders.***
>
> **Concept for Future Joint Operations**[23]

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[22]Bill Gates, The Road Ahead, 2nd ed. (New York: Penquin Books, 1996), 301.
[23]Joint Chiefs of Staff, Concept for Future Joint Operations. (Washington, D.C.: May, 1997), 74.

A commander is cultivated through a career of education, training and practical experience. The Joint Vision 2010 "system of systems" will collect, analyze, and distribute for assimilation an amazingly vast amount of information. Many current, manpower intensive decision support functions will likely become automated within the network.[24] With less hands-on processing, and the potential for information overload, future leaders will likely require a more formal education in decision making and information management. Since the patterns of good and bad decision making can be tracked though all levels, the use of decision support systems, both portable and fixed, should be instituted into all decision oriented and leadership curriculums. They should also, through embedded simulation, provide for the execution of leadership and decision making problems, as well as exercise the use of information management skills.[25] Through simple analysis as well as more sophisticated means such as software agents, they should be able to provide qualitative feedback on individual leadership and decision traits, enabling improved self knowledge as well as confidence in decision making ability.

As with any curriculum, emphasis in training will shift over time to meet the needs of the student. Arguably, the military has historically developed its commanders largely through on the job training. Their leadership and decision making skills have evolved through command influence and exposure to both good and bad leadership and decision processes beginning at the tactical level and continuing through the upper echelons. Over

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[24]Arthur Cebrowski and John Gartska, "Network-Centric Warfare: It's Origin and Future", Naval Institute Proceedings, January, 1998, 32.

[25]David S. Alberts, "The Unindtended Consequences of Information Age Technologies", National Defence University Books, April 1996, <http://www.ndu.edu/ndu/inss/books/uc/recom.html> (31 January 1998).

time, these commanders have collected a series of sources, processes and methods -- a legacy of support -- which have been reliable for them in the long term.

The commanders in 2010 are the middle and junior grade officers of today. Through experience, and a possible distrust of unproven new systems, they will probably have developed a support legacy to fall back on and may be better equipped to shift to more intuitive decision making. They are also likely to have a more difficult time recognizing when to transition to an alternate support mode because they will not have had the opportunity to gain an intuitive "feel" for system reliability. Therefore, a solid knowledge of not just the capabilities of systems, but their vulnerabilities and limitations as well, will be vitally important. Over stated "sales pitches" on capabilities could be fatal in the 2010 environment. Commanders must know the ground truth on information systems to develop realistic expectations and make responsible determinations on their reliability. Though situationally dependent, career education requirements for the commander in 2010 may be more critical in information management and systems operation than in leadership and decision making.

Conversely the commander in 2020, having been educated and trained in a more automated and technological environment, may not have the luxury of having a legacy of intuitive sources to fall back on without formalized training. This commander will probably manage information systems intuitively, be able to better anticipate the reliability of the information provided by them, as well as possess a better sense of which technological alternatives may be available to get a semblance of a support system up and running again. Thus, for the commander in 2020, career education requirements may be more critical in

leadership and decision making processes than in information management. The key point here is that the educational structure must be adaptive to the prospective commander's educational requirements.

Support Systems Development

> ***The implications of improved systems integration are both profound and complex.***
>
> **Joint Vision 2010**[26]

Embedded simulation can provide a valuable tool for building information management and collective decision making skills. Any system failure, whether induced through viral attack, power grid failure, or any one of a number of possibilities, will inevitably slow the decision process. The commander will ultimately be responsible for continued command and control. As such, a sound knowledge of the capabilities and limitations of people and assets, as well as possess confidence in self will also be required. The decision support systems which will serve as an interface for the commander and staff should also provide for the continued honing of decision making and information management skills. One possibility for meeting this need would be to include an embedded network and stand alone exercise simulation capability that also provides qualitative feedback on both individual and collective performance. With such a system, exercise problems could be run simulating varying levels of degradation, thus exercising that intuitive muscle in decision making, developing confidence and awareness on the part of the staff and the commander, as well as identifying problem areas which need further attention.

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[26]Joint Chiefs of Staff, Joint Vision 2010. (Washington D.C.: July, 1996), 15.

A decision support interface and displays isolated from information fill could help minimize the variables in a rapidly changing environment. The volume of information available and the technology that provides it under normal operation will likely make the staff the limiting or inhibiting factor in developing a solid picture of the battlespace. When a system failure occurs, however, a massive shift in workload, from information management tasks to information seeking and analysis, will occur. Whenever a large shift in tasking such as this takes place, it is best to minimize the variables that the human operator has to contend with. Thus, the user interface and basic functionality of decision support systems should be separated from fill, effectively isolated by design from the information they process. The look and feel of the interface should be the same whether the "system of systems" is at full capacity or operating on a very degraded basis. With this sort of design, a system invaded by viral attack, for example, could be secured, then archived drives containing the functional system as well as baseline intelligence information installed, and a stand alone support system up and running in minimum time. Though inevitably hindered by a degradation in information flow, decisions could still be made in a familiar environment based on the best, if time late, information available. An architecture such as this would also allow for easier transition to operations in classification sensitive environments, such as coalition warfare, Military Operations Other Than War (MOOTW), or Peace Keeping Operations (PKO).

The commander and staff should have indicators to assess the status of the grids they are operating within. This might be accomplished through designing a central status display in the decision support system, textually and/or graphically providing the "pulse" of the network in terms of factors critical to that particular command center, aiding the staff much

like a vital statistics monitor aids the physician when working with a patient. Properly designed, the commander could anticipate degradation or failures based on "pulse" cues and compensate accordingly.

User Feedback Mechanisms

Instituting newer, faster and more complex information systems will make constructive user feedback and lessons learned, both positive as well as negative, vital to achieving success. Establishing the "system of systems" will, out of necessity, be an iterative process, where problems encountered as well as solutions and lessons learned provided by the warfighters themselves will ultimately drive the direction of growth. For this to be effective, the users of these growing systems need to be proactive in their design.

The absolute best time to get feedback from the users is when issues are at the forefront of their mind. Information and decision support systems should provide the user with easy "one click" or "one word" access to process save functions and standardized, on screen lessons learned, system change request, and request for information forms. Data compiled in this manner would likely be much more complete and accurate than is produced by the present, almost afterthought type of processing. Additionally, by automating and standardizing these electronic forms, statistically significant trends in problem reporting and change requests could provide valuable insight into and justification for true upgrade and acquisition requirements, better supporting the needs of the warfighter.

CONCLUSIONS

The information age is not a period in the future, it is here today. We are already beginning to experience the impact that technology will have on the manner and speed at which we operate and are developing a reliance on information systems in the performance of our day to day tasks. Continual, accurate, rapid assessment of the validity of the battlespace picture, information management and rapid adaptation to changing levels of information flow will greatly increase in importance to the decision process as we progress further towards the Joint Vision 2010 concept of information superiority. To provide for success, it will become imperative in the cultivation of future commanders that all levels of their career professional education include the development of sound leadership, decision making and information management skills. Various measures, such as embedding simulation and exercise tools into the decision support architecture, should be taken to ensure that the leadership and decision making skills required for a commander to be effective are continually challenged and well honed. Lastly, the users of these information and decision support systems must be proactive in providing continual, accurate, and timely feedback on problems, solutions and lessons learned to ensure that our transition to information superiority is done in a smart and effective manner.

APPENDIX A

The Decision Making Process[27]

The Key Elements

The decision making process can be broken down into four main elements. Every good decision maker must, consciously or unconsciously, go through each of them.

They are:

1. **Framing:** Structuring the question. This means defining what must be decided and determining in a preliminary way what criteria would cause you to prefer one option over another. In framing, good decision-makers think about the viewpoint from which they and others will look at the issue and decide which aspects they consider important and which they do not. Thus the inevitably simplify the world.

For example, in deciding whom to promote, you may simply define the problem as: "Selecting the person whose leadership is likely to produce the best performance in the work group." Note that this viewpoint pushes other aspects of the issue into the background, such as ability to connect with other parts of the organization, rapport with external clients, or rewarding the employee who has worked hardest or who has most seniority.

2. **Gathering Intelligence:** Seeking both the knowable facts and the reasonable estimates of "unknowables" that you will need to make the decision. Good decision-makers manage intelligence-gathering with deliberate effort to avoid such failings as overconfidence in what they currently believe and the tendency to seek information that confirms their biases. As Will Rogers said, "It's not what we don't know that causes trouble. It's what we know that ain't so."

3. **Coming to Conclusions:** Sound framing and good intelligence don't guarantee a wise decision. People cannot consistently make good decisions using seat-of-the-pants judgment alone, even with excellent data in front of them. A systematic approach forces you to examine many aspects and often leads to better decisions than hours of unorganized thinking would.

For example, numerous studies have shown that novices as well as professionals make more accurate judgments when they follow systematic rules than when they rely on their intuitive judgment alone.

4. **Learning (or failing to learn) from feedback:** Everyone needs to establish a system for learning from the results of past decisions. This usually means keeping track of what you expected would happen, systematically guarding against self-serving explanations, then making sure you review the lessons your feedback has produced the next time a similar decision comes along.

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[27]Excerpt from J. Edward Russo and Paul J.H. Schoemaker, Decision Traps. The Ten Barriers to Brilliant Decision Making and How to Overcome Them. (New York: Dell Publishing Group, Inc., 1990) , 2-4.

Decision Traps[28]

The decision research of the last two decades has shown that people in numerous fields tend to make the same kinds of decision-making mistakes. So whatever kind of decision you have to make, you can probably use the insights a small group of researchers have developed to prevent those mistakes.

We have highlighted the most common errors in the following ten "decision traps." You'll find that these errors plague different parts...of your decision-making process.

1. **Plunging in:** Beginning to gather information and reach conclusions without first taking a few minutes to think about the crux of the issue you're facing or to think through how you believe decisions like this one should be made.
2. **Frame Blindness:** Setting out to solve the wrong problem because you have created a mental framework for your decision, with little thought, that causes you to overlook the best options or lose sight of important objectives.
3. **Lack of Frame Control:** Failing to consciously define the problem in more ways than one or being unduly influenced by the frames of others.
4. **Overconfidence in Your Judgment:** Failing to collect key factual information because you are too sure of your assumptions and opinions.
5. **Shortsighted Shortcuts:** Relying inappropriately on "Rules of Thumb" such as implicitly trusting the most readily available information or anchoring too much on convenient facts.
6. **Shooting from the Hip:** Believing you can keep straight in your head all the information you've discovered, and therefore failing to manage the group decision-making process.
7. **Group Failure:** Assuming that with many smart people involved, good choices will follow automatically, and therefore failing to manage the group decision-making process.
8. **Fooling Yourself About Feedback:** Failing to interpret the evidence from past outcomes for what it really says, either because you are protecting your ego or because you are tricked by hindsight.
9. **Not Keeping Track:** Assuming that experience will make its lessons available automatically, and therefore failing to keep systematic records to track the results of your decisions and failing to analyze these results in ways that reveal their key lessons.
10. **Failure to Audit Your Decision Process:** Failing to create an organized approach to understanding your own decision-making, so you remain constantly exposed to all the above mistakes.

In simple decisions -- say, whether to return a phone call -- you probably do not need to worry about these decision traps. . .But in big decisions -- the decisions that determine the success of your life and that of those around you -- The decision traps frequently cause havoc.

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[28]Excerpt from J. Edward Russo and Paul J.H. Schoemaker, Decision Traps. The Ten Barriers to Brilliant Decision Making and How to Overcome Them. (New York: Dell Publishing Group, Inc., 1990) , xvi-xvii.

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